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The MIXED-FEEDS Industry

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AGRICULTURAL ECONOMISTS

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THE MIXED-FEEDS INDUSTRY

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SUMMARY

The mixed-feeds industry has grown rapidly during recent years. Between 1939 and 1947, the number of feed-mixing plants in the United States almost doubled and the number of employees per plant increased about 18 percent. Its 2 billion dollars' worth of sales in 1947 made the industry one of the Nation's largest.

Feed-mixing plants increased in number throughout the country, but the rate of increase varied among regions. The greatest increases occurred in the East North Central, West North Central, East South Central, and South Atlantic regions. The first two of these regions, the East and West North Central, are the major surplus-production areas for feed ingredients. The two latter regions, the East South Central and the South Atlantic, are deficit ingredient-producing areas.

In 1947, the Middle Atlantic region was the largest producer of mixed feeds, measured by the industry's use of leading ingredients. This region had a volume of production 12 times as large as that of the area of smallest production--the Mountain region. Roughly half of the ingredients entering into production of mixed feeds were whole grains and cornmeal. The second largest group of ingredients--vegetable oil meals--accounted for about 16 percent of the total. Consumption

of many individual ingredients varied among the different regions. This indicates that considerable substitution may have occurred because of efforts by the industry to minimize costs of raw materials by using locally produced ingredients, while attempting at the same time to maintain the quality of the mixed feeds.

About half of the mixed feeds produced in 1947 were poultry feeds. Cattle feeds were next, making up 26 percent of the total. Processed grain and mixed feeds for other farm livestock such as hogs and other animals such as mink and rabbits, made up the remainder.

Seven ingredients - corn, millfeeds and screenings, soybean meal, oats, wheat, alfalfa meal, and barley, in that order - were widely used by the mixed-feeds industry in 1947. These seven account for more than 70 percent of all the ingredients used by the industry in that year.

The mixed-feeds industry is faced with the problems of maintaining large enough stocks of ingredients to continue operations, of minimizing risks from price changes, and of holding down its storage needs to practical levels. Thus policies of feed manufacturers with regard to purchase and storage of ingredients varied widely. Manufacturers located in areas of surplus production tended to hold smaller stocks than those in deficit areas. There was also a tendency to buy as needed those ingredients which are used in larger volumes, primarily grain. Other ingredients were ordinarily bought in advance. Most manufacturers, however, apparently try to carry as small a stock of ingredients as feasible.

In the United States, seasonality of production varies considerably for individual types of mixed feeds. But, combining all mixed feeds there is only about a 30-percent difference between total production in the high and in the low months of the year. Production throughout the year varies somewhat among regions. Not only does the seasonal pattern differ among regions in terms of the high and low months but the size of the fluctuation also varies. The greatest seasonality apparently exists in those regions that have the largest volume of production. The smallest seasonal variation is found in those regions with the smallest production.

In 1947, on the average, parts, materials, containers, and supplies amounted to 81.5 percent of the value of finished products. This is indicated by a preliminary analysis of secondary data on the cost of operating feed-mixing plants. The remaining 18.5 percent included payment for salaries and wages, other production costs, and a residual for profit.

The rapid growth of the mixed-feeds industry raises questions as to the factors that should influence the location of new mixing plants. It also raises questions as to the size and design of plants that would lead to maximum efficiency.

INTRODUCTION

The mixed-feeds industry represents a growing market for grains, alfalfa meal, and byproduct feeds. It also supplies an increasing proportion of our total feed requirements, especially for poultry and dairy cattle.

Many farmers, particularly those in feed-deficit areas, depend upon commercial mixed feeds for most of their feed supply. Other farmers, especially those in feed-surplus areas, use mixed feeds primarily as supplements to home-produced feeds.

The industry grew rapidly under the impact of many factors. Among these were high prices for livestock and livestock products, relative shortages of many kinds of feeds, and a desire for better-balanced diets. From 1939 through 1947, according to the Census of Manufactures, production of mixed feeds more than doubled. During this period, the feeding of all concentrates increased only 20 percent.

The rapid growth of the mixed-feeds industry indicates a need for study of desirable sizes and designs for new plants. As parts of the rapid growth occurred both in surplus and in deficit ingredient-producing areas, need was indicated for a study of the most desirable location of the industry in relation to sources of supplies of ingredients, to markets, and to transportation and other costs.

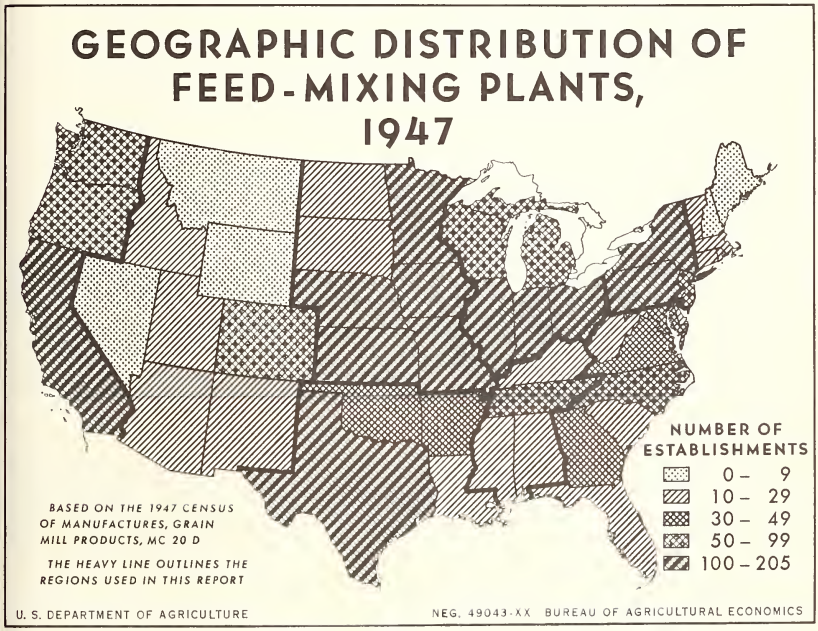
This report is part of a larger study of marketing costs and efficiency in the mixed-feeds industry. This part of the study is intended to bring together all the available data which are essential to the overall analysis. It is based on published literature - primarily for 1947 and earlier. More recent data are not available, except to indicate that from 1947 to 1951 the value of sales increased about 22 percent. This dynamic industry apparently changed also with respect to the ingredients and processing methods it used and in variety and composition of its final products. For example, rapid growth has occurred since 1947 in the use of trace elements, vitamin carriers, and antibiotics.

The larger study is designed to develop criteria to serve as guides to new firms in locating plants and in designing them for volumes of operation that will tend to increase the efficiency of the mixed-feeds industry as a whole. It is believed that these criteria will also be of help to established firms.

This larger study is conducted under authority of the Agricultural Marketing Act of 1946 (RMA, Title II), one of the stated purposes of which is "to determine costs of marketing agricultural products in their various forms and through the various channels and to foster and assist in the development and establishment of more efficient marketing methods (including analyses of methods and proposed methods), practices, and facilities, for the purpose of bringing about more efficient and orderly marketing, and reducing the price spread between the producer and the consumer."

GEOGRAPHIC IMPORTANCE OF THE INDUSTRY

In general, the mixed-feeds industry is concentrated in the Midwest, Middle Atlantic, and Pacific regions. More than 50 percent of the feed-mixing plants in the United States are in a belt comprised of States beginning with New York and Pennsylvania and extending westward (fig. 1). In each of the 10 States in this belt, including California and Texas, there are more than 100 plants. An additional 8 States--New Jersey, Michigan, Wisconsin, North Carolina, Tennessee, Colorado, Washington, and Oregon--have between 50 and 100 plants each. Together, these 20 States account for slightly more than 80 percent of the feed-mixing establishments in the United States. In addition to showing the importance of the mixed-feeds industry in each State, figure 1 outlines the regions used in the discussion that follows.


GEOGRAPHIC DISTRIBUTION OF FEED-MIXING PLANTS, 1947
NUMBER OF ESTABLISHMENTS
0 - 9
10 - 29
30 - 49
50 - 99
100 - 205
BASED ON THE 1947 CENSUS OF MANUFACTURES, GRAIN MILL PRODUCTS, MC 20 D
THE HEAVY LINE OUTLINES THE REGIONS USED IN THIS REPORT
U. S. DEPARTMENT OF AGRICULTURE
NEG. 49043-XX BUREAU OF AGRICULTURAL ECONOMICS

GROWTH OF THE INDUSTRY

The value of products shipped by the mixed-feeds industry was more than five times greater in 1947 than in 1939. Growth of the industry from 1927 to 1947 is shown also in table 1. Increases in the price level account for a part of this change but much of it is the result of the rapid expansion of the industry. In 1947, manufacture of prepared animal feeds was the tenth largest industry in the United States, according to the Standard Industrial Classification 1/ used by the Bureau of the Census.

Table 1.- Prepared animal feeds industry: Number of establishments, number of employees, and value of shipments, 1927-47

Census year	Establishments	All employees	Production and related workers	Value of products shipped
	Number	Number	Number	1,000 dollars
1947	2,689	55,347	40,266	2,130,263
1939	1,383	24,177	15,401	410,880
1937	1,126	19,190	14,397	415,211
1935	942	15,427	11,606	288,662
1933	710	11,340	8,791	161,343
1931	796	1/	8,449	209,921
1929	750	14,384	10,223	402,753
1927	447	11,378	7,632	299,793

1/ Not available.

Reproduced from the 1947 Census of Manufactures, Grain Mill Products, MC20D, table 1.

In that year, the mixed-feeds industry was composed of more individual companies with relatively smaller volumes of sales than most of the 37 other industries that had sales values of a billion dollars and more. The four mixed-feed companies which had the largest volumes of shipment accounted for only 18.8 percent of the total value of shipments in the industry. Eight companies handled about 26.7 percent of the total value, the first 20 companies 39.8 percent, and the first 50 companies 53.3 percent. On the basis of the 1935 and 1947 Censuses of Manufactures, the concentration ratio appears to have declined with the growth of the industry. In 1935, the 4 largest mixed-feed companies did 23.0 percent of the business and the first 8 made 34.3 percent of the total sales.

1/ U. S. Department of Commerce, Concentration of Industry Report, Business Information Service, December 1949, table 1, p. 4.

New York was still the major producing State in 1947. In terms of dollars, it had increased output to 3.5 times its 1939 sales. The second largest producer in 1939--California--retained that place in 1947. Its 1947 sales value was more than four times that recorded in the previous census. Ohio, with the greatest increase in sales of the top five States, had a value of sales in 1947 that was six times that of 1939. This State became the third largest producer. Illinois dropped to fourth position in 1947, even though the value of sales in that year was 4.5 times the 1939 figure. The fifth largest producing State in both years--Missouri--increased sales to 5.4 times that of the earlier year. In 1947, each of these States manufactured more than a hundred million dollars' worth of mixed feeds.

Number of Establishments

From 1939 to 1947, the number of establishments primarily engaged in mixing feeds almost doubled (table 2). Although every region of the country showed an increase in number of plants, the rate of increase varied by regions.

In 1947 the West North Central region had 694 plants, more than any other region. 2/ It also had the greatest increase in number of feed-mixing establishments; the 1947 Census reported slightly more than three times as many plants as in 1939. In the other regions, the number of feed-mixing plants increased most rapidly in the East North Central, East South Central, and South Atlantic States. This list contains the major surplus regions--the two North Central regions--as well as two of the regions with the largest deficit--the East South Central and the South Atlantic. In these two latter regions, production of livestock and broilers has increased considerably. This rapid growth in two quite different regions focuses attention on the question, What are the factors that influence the location and growth of the mixed-feeds industry?

In several regions, increases in number of feed-mixing plants were less rapid than the average for the United States as a whole. Most notable was the New England region, which gained only six plants. Increases in plant numbers in the Middle Atlantic region, which had the greatest number in 1939, and in the Pacific region, which had the second largest number in that year, were below the United States average.

2/ The 1947 Census definition of what is included in the mixed-feeds industry--establishments primarily engaged in manufacturing prepared feeds for animals and fowls--is used. In this definition, small farm-supply dealers, whose sales of merchandise such as farm equipment and branded feeds exceeded sales of mixed feeds of their own manufacture, were included if they produced 2,000 tons or more of feed during the year, and if they maintained separate records on their manufacturing activities. See Census of Manufactures, 1947, Bul No. MC20D, p. 1 for greater detail.

Minnesota had 116 more feed-mixing plants in 1947 than in 1939, the greatest increase for any State. The greatest percentage gains were in South Dakota, Nebraska, and Minnesota, in that order. South Dakota's percentage gain was large, but its number of plants is small. Nebraska and Minnesota had substantial gains in both absolute and relative terms. Although the number of establishments increased in most of the States, several showed decreases. Washington, for instance, had a 25-percent decrease. Plant numbers in three other States--Maine, Vermont, and Rhode Island--either decreased or showed no change.

Size of Plants

Regional differences, 1947.- Approximately 7,000 tons of ingredients were used per plant in the United States during 1947. In terms of ingredients used, the average size of plant varied considerably by regions, ranging from 3,000 to 14,000 tons a year. These estimates are based on ingredients used and number of plants, as reported in the 1947 Census of Manufactures for the "prepared animal feeds industry." Ingredients used by this industry accounted for about 85 percent of the total feeds produced by the mixed-feeds industry as a whole, again as reported in the Census. Precise comparisons of regional differences in average volumes of production per plant are impossible as the degree of incompletion varies by region. Even so, a general picture of regional plant volumes can be obtained. In two regions with relatively small feed-mixing industries--New England and West South Central--the average size of plant was about double the United States average. In the Middle Atlantic region, where the feed-mixing industry was largest, the average production per plant was more than 150 percent of the United States average of 7,000 tons. In contrast, in the West North Central region, also a heavy-volume region, the average production per plant was only about 50 percent of the national average. In the Mountain region, which has the smallest feed-mixing industry, the average production per plant was only a third of the national average. In the other regions, East North Central, Pacific, South Atlantic, and West South Central, average production per plant was roughly comparable to the United States average.

Number of employees per plant.- The number of employees per plant increased rapidly between 1939 and 1947, thus implying an increase in size of plant as well as in number of plants. The average number of employees per plant increased 18 percent, from 17.5 employees in 1939 to 20.6 in 1947 (table 2). Of course, increases in number of employees per plant may have been offset by decreases in output per worker. But it seems likely that technological advances in the industry have increased output per hour worked more than enough to offset any reduction in hours worked per employee.

Table 2.- Mixed-feeds industry: Plants operating, number employed, and changes, by States and regions, 1939 and 1947

State and region	Plants				Employees							
			Change		Total				Per plant			
							Change				1947 as a percentage of 1939	
	1939	1947	Actual	1947 as a percentage of 1939	1939	1947	Actual	1947 as a percentage of 1939	1939	1947	All employees	Production workers
	Number	Number	Number	Percent	Number	Number	Number	Percent	Number	Number	Percent	Percent
Maine 1/	4	4	0	0	—	61	--	--	--	15.2	—	--
Vermont 1/	19	17	- 2	89	—	628	--	--	--	36.9	--	--
Connecticut 1/	6	11	5	183	—	218	--	--	—	19.8	--	—
Rhode Island 1/	1	0	- 1	-100	—	0	--	--	—	—	—	—
Massachusetts	24	27	3	112	512	822	310	160	21.3	30.4	143	--
New Hampshire	5	6	1	120	89	141	52	158	17.8	23.5	132	—
New England	59	65	6	110	601	963	362	160	20.7	29.2	141	—
New York	123	147	24	120	3,597	5,056	1,459	140	29.2	34.4	118	136
New Jersey	31	55	24	177	458	932	474	203	14.8	16.9	114	129
Pennsylvania	133	176	43	132	1,219	2,310	1,061	185	9.4	13.1	139	154
Middle Atlantic	287	378	91	132	5,304	8,298	2,994	156	18.5	22.0	119	136
Ohio	70	137	67	196	1,518	3,107	1,589	205	21.7	22.7	105	114
Indiana	48	126	78	262	591	1,862	1,271	315	12.3	14.8	120	155
Illinois	55	127	72	231	2,246	5,407	3,161	241	40.8	42.6	104	95
Michigan	31	68	37	219	247	518	271	210	8.0	7.6	95	--
Wisconsin	33	93	60	282	282	934	652	331	8.5	10.0	118	--
East North Central	237	551	314	232	4,884	11,828	6,944	242	20.6	21.5	104	--
North Dakota 1/	0	12	12	--	—	31	--	--	--	2.6	—	—
South Dakota 1/	3	16	13	533	--	141	--	--	—	8.8	—	--
Minnesota	37	153	116	414	382	1,747	1,365	457	10.3	11.4	111	--
Iowa	77	151	74	196	1,219	2,091	872	72	15.8	13.8	87	—
Missouri	45	114	69	253	1,026	2,725	1,699	266	22.8	23.9	105	--
Nebraska	24	111	87	462	341	1,441	1,100	422	14.2	13.0	92	--
Kansas	37	137	100	370	550	1,885	1,335	343	14.9	13.8	93	--
West North Central	223	694	471	311	3,518	9,889	6,371	281	16.0	14.8	92	—
Delaware 1/	6	12	6	200	--	324	—	--	—	27.0	—	—
Maryland	28	33	5	118	602	657	55	109	21.5	19.9	92	--
West Virginia	3	10	7	333	20	241	221	1,205	6.7	24.1	360	--
Virginia	16	49	33	306	239	1,095	856	458	14.9	22.3	150	134
North Carolina	16	57	41	356	251	1,395	1,144	556	15.7	24.5	156	180
South Carolina	10	16	6	160	144	314	170	218	14.4	19.6	136	140
Georgia	14	33	19	236	371	915	544	247	26.5	27.7	104	138
Florida	15	24	9	160	181	791	610	437	12.1	33.0	273	--
South Atlantic	108	234	126	217	1,808	5,408	3,600	299	17.7	24.4	138	--
Kentucky	9	28	19	311	114	584	470	512	12.7	20.8	164	168
Tennessee	23	53	30	230	854	2,124	1,270	249	37.1	40.1	108	122
Alabama	10	17	7	170	364	917	553	252	36.4	53.9	148	240
Mississippi	6	12	6	200	151	548	397	363	25.2	45.7	181	222
East South Central	48	110	62	229	1,483	4,173	2,690	281	30.9	37.9	123	152
Arkansas	11	35	24	318	220	594	374	270	20.0	17.0	85	100
Texas	59	114	55	193	984	3,225	2,241	328	16.7	28.3	169	195
Louisiana	9	14	5	156	352	675	323	192	39.1	48.2	123	—
Oklahoma	25	44	19	176	375	681	306	182	15.0	15.5	103	--
West South Central	104	207	103	199	1,931	5,175	3,244	268	18.6	25.0	134	--
New Mexico 1/	9	11	8	367	--	117	--	--	--	10.6	—	--
Wyoming 1/	—	2	2	--	--	--	—	--	—	--	--	--
Nevada 1/	2	4	2	200	—	--	—	--	—	--	—	--
Idaho	11	19	8	173	57	195	138	342	5.2	10.3	198	200
Montana	6	9	3	150	60	91	31	152	10.0	10.0	100	--
Colorado	38	60	22	158	460	705	245	153	12.1	11.8	98	--
Arizona	4	13	9	325	65	362	297	557	16.2	27.8	172	--
Utah	12	23	11	192	143	246	103	172	11.9	10.7	90	--
Mountain	96	141	65	186	785	1,599	814	204	11.0	12.9	117	--
California	130	205	75	158	2,232	4,828	2,596	216	17.2	23.6	137	144
Washington	67	50	- 17	75	573	749	176	131	8.6	15.0	174	--
Oregon	43	54	11	126	451	875	424	194	10.5	16.2	154	--
Pacific	240	309	69	129	3,256	6,452	3,196	198	13.6	20.9	154	--
United States	1,383	2/2,689	1,306	194	24,178	3/55,347	31,169	229	17.5	20.6	118	135

1/ Data for these States excluded from regional totals and computations in employee columns.
2/ Includes one plant in the District of Columbia.
3/ Figure shown is actual U. S. total. Census reported figure is 24,177.

1939 Census of Manufactures and 1947 Census of Manufactures, Grain Mill Products, Prepared Feeds for Animal and Fowls.

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For the States with comparable data for 1939 and 1947, data as to the number of employees per feed-mixing plant were computed from published census information. For regions where comparable data were not available for all States, the regional totals given here are estimates only (table 2). Although in this analysis the total number of employees is used to indicate changes in size of plant (because this information is more complete), the number of production employees would appear to be a more accurate indication. The average change in the number of production workers per plant for the United States as a whole was even greater than the average increase in all employees. For those States in which comparable data relating to production workers were available, the percentage change between 1939 and 1947 was also computed. In most of these States, the increase in the number of employees per plant is further substantiated. Of the 18 States for which data on all employees and production workers were available, 16 showed greater increases in numbers of production workers than in numbers of all employees.

The number of workers per feed-mixing plant has tended to increase in every region except the West North Central. Apparently this region has always had a smaller number of employees per plant than other regions. In 1939 it was the third lowest region in this respect and in 1947 it dropped to second lowest. This relative shift occurred partly because of actual downward trends in number of employees per plant in this region (table 2) and partly as a result of the increase in number of employees operating in each plant in other regions. In other words, the tendency in this region was not only for old plants to refrain from increasing the number of employees per plant but also for new plants to design their operations for the same size, so far as number of employees was concerned. The Pacific region had the greatest increase in size of plant; 54 percent more employees per plant were employed in 1947 than in 1939.

The number of employees per feed-mixing plant was usually smaller in those States located in regions of high production than in those located in areas of low production. Of the 10 States having the largest number of employees per plant in 1947, 7 were in regions of comparatively small production; that is, Nes England, and the East and West South Central regions. In 1947 Illinois, along with a block of the Southern States--Alabama, Louisiana, Mississippi, and Tennessee--employed twice as many workers per feed-mixing plant as the United States average. New York, the State having the largest mixed-feeds industry, had the same percentage increase in number of employees per plant as the United States, 18 percent greater than in 1939. California, the second largest producer, increased more rapidly than the United States average, while Ohio, the third largest producer, dropped below the average. Eight States showed a decrease in average number of employees per plant.

TYPES AND COMPOSITION OF MIXED FEEDS PRODUCED

Of the total quantity of mixed feeds produced in 1947, 49 percent was poultry feeds and 26 percent was cattle feeds, both dairy and beef. The largest single group of feeds produced was dairy feed, under 25 percent protein content; followed by chicken mash and pellets, under 25 percent protein (for layers and breeders); and then by scratch feeds. A breakdown of the type of feeds produced and their relation to total production of mixed feeds in the United States follows:

Type of feed 1/	Quantity
	Thousand tons
Poultry and livestock feeds, total	22,298
Grain (ground, rolled, chopped, or crimped)	1,584
Poultry feeds:	
All scratch feeds	1,755
Chicken mash and pellets, under 25 percent protein	
Layer and breeder	4,318
Starter	960
Grower	1,173
Broiler	1,522
Turkey mash and pellets, under 25 percent protein	547
Other poultry feeds under 25 percent protein	612
Supplement and concentrates, 25 percent protein and over	832
Livestock feeds:	
Dairy, under 25 percent protein	4,664
Dairy, 25 percent protein and over	608
Beef and range cattle	436
Sheep and goat	71
Pig and hog, under 25 percent protein	771
Pig and hog, 25 percent protein and over	707
Horse and mule	534
Other livestock feeds 2/	757
Poultry and livestock feeds, kind not specified	447

1/ 1947 Census of Manufactures, Grain Mill Products, MC20D.
2/ Includes feed for rabbits, mink, foxes, and laboratory and other animals.

The average composition of these various types of feed differs considerably. In order to show some of these variations the composition, in terms of broad groups of ingredients, of the feeds produced in greatest volume is shown in table 3.

Table 3.- Composition of average mixed-feed rations

Ingredients by major groups	Dairy feeds 1/	Mashes		Growing scratch feed 2/
		Laying and breeding 2/	Broiler 2/	
	Percent	Percent	Percent	Percent
Grains	33.0	53.6	54.0	100.0
Millfeeds and screenings	17.8	22.6	17.1	-
Byproducts of the grain industry	22.0	1.3	5.6	-
Total grains	72.8	77.5	76.7	100.0
Oil meals	21.4	8.2	12.8	-
Animal proteins	-	7.4	8.0	-
Total high protein supplements	21.4	15.6	20.8	-
Alfalfa meal	-	6.9	2.5	-
Byproducts of sugar and citrus industries	5.8	-	-	-
Total miscellaneous	5.8	6.9	2.5	-
TOTAL	100.0	100.0	100.0	100.0

1/ Average of all dairy rations having 20-percent protein content.
2/ Average of all rations in this category.

Based on 1947 Feed Trade Manual.

Although it cannot be measured, a high degree of substitution occurs among ingredients within the three major groups of ingredients--grains and grain products, high proteins, and miscellaneous supplements. In some cases, ingredients can be substituted among the major groups. The similarity between vegetable oil meals and corn gluten feed, a byproduct of the corn wet-milling industry, makes this especially true so far as these groups are concerned. Within any group, the tendency is to use ingredients that can be produced at lowest cost, including cost of transportation, and still meet the requirements of the mixing formula. Thus, large quantities of fish meal and scrap are used in the Middle Atlantic, East North Central, and Pacific regions. These regions are all heavy feed-mixing areas which are near large bodies of water. In 1947, California led in production of sugar beets and mixers in the Pacific region used the greatest quantity of beet pulp. Soybean cake and meal was the oil meal most widely used in the East North Central region, the leading area in production and processing of soybeans. The

West South Central region, which leads in production of cotton, used much cottonseed cake and meal. Substitution also takes place among the grains. The Pacific region, where large quantities of barley and little corn are grown, makes much more use of barley than does the West North Central region, which has ample supplies of both grains. Percentagewise, this regions uses more barley than any other and less corn than any area, except the Mountain region, where production is small.

ESTIMATED PRODUCTION OF INGREDIENTS COMPARED WITH CONSUMPTION BY INDUSTRY

The seven ingredients most widely used by the mixed-feeds industry in 1947 were corn, millfeeds and screenings, soybean meal, oats, wheat, alfalfa meal, and barley, in that order. More than 700,000 tons of each of these ingredients were used by the commercial feed-mixing industry. These ingredients make up more than 70 percent of the total used by the industry.

Production of Ingredients

The East and West North Central regions combined produced 64 percent of the total production of ingredients in the United States. The West North Central region led in production of five of the seven chief ingredients and was the second largest producer of the two remaining--soybean meal and corn. These two commodities were primarily produced in the East North Central region, which was also the second largest producer of millfeeds and screenings, and oats. Three other regions ranked second for one ingredient each, the West South Central in wheat, the Mountain in alfalfa meal, and the Pacific in barley.

As defined in this report, production refers to the quantity of each ingredient sold by producers rather than the total produced. This is especially important in the case of grains, large quantities of which are used on farms where produced or are sold to other farmers. Data used in this analysis for corn, oats, wheat, and barley, therefore, represent the quantities actually sold, not the total produced. As wheat offal, a byproduct of the flour industry, comprises nearly all of the total production of millfeeds, its production was used in comparing production and consumption of millfeeds and screenings. Production of alfalfa meal was used as such because the major part of this production is processed in dehydrating plants and is available to buyers other than farmers. In computing production of soybean meal, production of soybeans by States was deflated to the quantity crushed, using the total production and crushing figures for the United States. 3/ A constant outturn of 48 pounds of meal per bushel of soybeans was used for all States.

3/ These limitations on the data do not affect the relationship of surplus and deficit areas to an appreciable extent. Soybean meal is the ingredient in which the largest inconsistencies could arise but an analysis of the production and crush in the 23 States for which crushing data were available indicates that this assumption is valid for the use made in this report.

Consumption by Feed Mixers

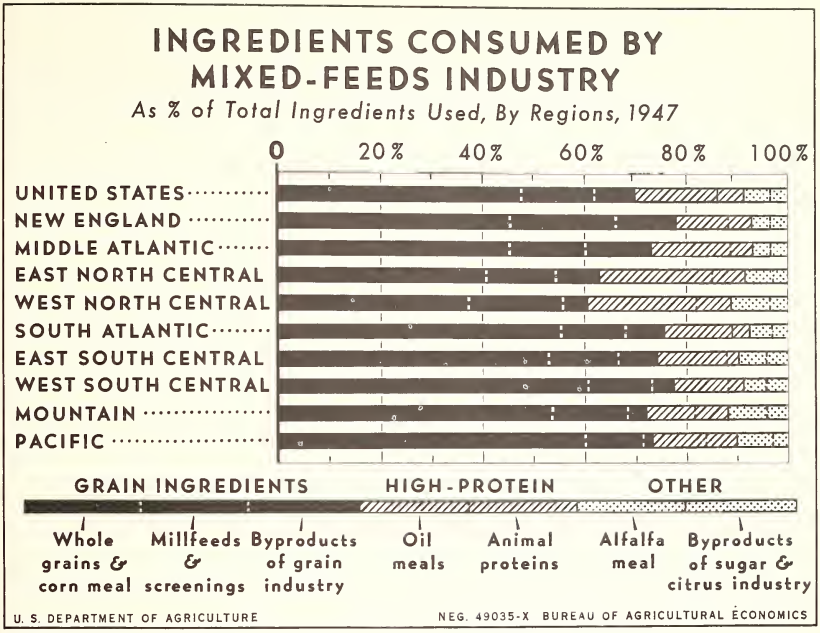
The mixed-feeds industry in the United States used more than 20 percent of the production of the seven major ingredients. Ingredients used by the feed-mixing industry are based on consumption of these ingredients by the industry as reported in the 1947 Census of Manufactures. 4/ Use of ingredients ranged from a low of 4.5 percent of the wheat produced for sale to a high of almost 100 percent for the alfalfa meal sold. About half of the production of millfeeds and screenings and also of soybean meal is used in the manufacture of mixed feeds.

Volume of production of mixed feeds and therefore the industry's use of ingredients follows somewhat the same pattern as that shown in figure 1 for number of plants. The industry in the Middle Atlantic region is the largest user of ingredients. It is followed closely by the East North Central region. Other regions in order of importance are the West North Central, Pacific, South Atlantic, East South Central, West South Central, New England, and Mountain regions. The Middle Atlantic region uses about 12 times as much as the Mountain region, and the Pacific region uses about the average quantity used in the nine regions of the United States.

Of the ingredients used in production of mixed feeds in the United States, 70 percent are grain or byproducts of grain. Figure 2 shows ingredients used, classified into three major groups. Consumption of whole grain and cornmeal ranges from a low of 37.5 percent of the total ingredients used in the West North Central region to a high of 60 percent in the West South Central and Pacific Coast regions. High-protein ingredients used by the industry vary between 13.8 percent of the total ingredients used in the West South Central region and about 28 percent in the East and West North Central regions. The national average is 21 percent. This variation in protein content can be explained partly by the relatively high-protein content of the average dairy ration and partly by the probability that the mixed feeds produced in the North Central region for shipment to other regions are made up of a relatively larger proportion of the higher protein premixes. 5/ Other ingredients, such as byproducts of the sugar and citrus industry and alfalfa meal, varied from 6.9 to 11.7 percent of the total ingredients used.

4/ The total value of products shipped by plants that reported use of ingredients was 94 percent of the total value of products shipped by the entire industry. In this report, therefore, the data on use of ingredients were expanded on the assumption that plants doing 94 percent of the total business in dollars used the same percentage of total ingredients.

5/ Premixes as used here refer to either high-protein feeding or mixing concentrates and are usually complete mixes, except that most of the grain ingredients are excluded.



When expressed as a proportion of total ingredients used, barley varies more among regions than does any other ingredient used in the manufacture of mixed feeds, as reported in the 1947 Census. The feed-mixing industry in the Pacific region includes 18 times more barley in the average ration than is in the average rations mixed in the South Atlantic region. On the other hand, the feed-mixing industry located in the Pacific region uses only a tenth as much brewers' and distillers' spent grain in its average ration as does the mixed-feeds industry in the Middle Atlantic region. Use of grain sorghum by the feed-mixing industry also varies considerably by regions. Alfalfa meal varies little among regions in terms of its use in the average ration, as it merely doubles between the highest and lowest regions. The use of molasses, which indicates wet mixing, also remains relatively stable among regions. The highest region uses only twice as much molasses in its average ration as does the lowest region.

Table 4.- Individual ingredients consumed by the mixed-feeds industry as a percentage of total ingredients, United States and regions, 1947

Ingredient	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	United States
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Grains	45.4	45.1	40.7	37.5	55.5	52.4	60.9	53.5	60.0	47.9
Corn	19.3	20.6	22.5	15.4	22.1	27.0	23.1	14.2	15.3	20.4
Oats	11.4	12.0	8.2	9.5	9.0	10.6	12.7	5.6	4.6	9.5
Wheat	4.1	4.2	2.6	3.7	16.0	5.6	9.9	7.9	13.6	6.6
Barley	1.8	2.3	1.7	1.5	1.0	1.5	1.3	15.9	18.3	3.9
Soybeans	1.7	.5	1.0	1.5	1.5	1.4	1.4	1.3	1.4	1.2
Sorghum grain	1.3	1.0	.7	2.0	1.2	1.7	9.1	3.9	5.4	2.3
Other grains 1/	.2	.5	.2	.2	.2	.2	.5	.2	.3	.3
Corn meal	5.6	4.0	3.8	3.7	4.5	4.4	2.9	4.5	1.1	3.7
Millfeeds and screenings	20.4	15.1	13.7	18.9	12.5	14.0	12.3	15.0	11.5	14.6
Byproducts of the grain industry	11.5	12.9	8.9	4.6	7.5	7.1	4.1	3.7	1.7	7.7
Corn gluten feed and meal	4.8	5.8	4.0	2.8	3.3	2.6	2.3	1.7	.5	3.5
Brewers' and distillers' spent grains	2.7	4.0	2.7	1.1	3.1	2.9	1.1	1.3	.4	2.4
Hominy feed and meal	4.0	3.1	2.2	.7	1.1	1.6	.7	.7	.8	1.8
Oil meals	10.3	15.7	22.2	21.5	13.0	14.0	10.8	9.5	10.4	16.0
Soybean cake and meal	9.1	12.9	19.6	17.1	8.5	10.5	5.8	7.0	6.1	12.6
Cottonseed cake and meal	.3	.5	1.2	1.9	2.3	2.8	3.6	1.6	1.2	1.5
Linseed cake and meal	.7	1.4	.9	2.0	.6	.4	.6	.7	1.1	1.1
Other cake and meal	.2	.9	.5	.5	1.6	.3	.8	.2	2.0	.8
Animal proteins	4.8	4.3	6.4	6.4	3.8	2.5	3.0	6.6	6.0	5.0
Meat scrap	2.8	2.6	4.0	3.7	2.1	1.4	2.0	4.2	3.3	3.0
Fish meal and scrap	1.3	1.0	1.0	.8	.9	.5	.4	.9	1.9	1.0
Tankage	.2	.2	.9	1.5	.3	.3	.3	.2	.2	.5
Dried whey	.4	.4	.3	.2	.4	.2	.2	1.2	.4	.3
Dried skim milk and buttermilk	.1	.1	.2	.2	.1	.1	.1	.1	.2	.2
Alfalfa meal	3.8	3.8	5.5	7.6	4.3	5.3	4.8	7.5	7.3	5.4
Byproducts of sugar and citrus industry	3.8	3.1	2.6	3.5	3.4	4.7	4.1	4.2	3.1	3.4
Molasses	3.6	2.8	2.0	3.2	2.8	4.3	3.6	4.0	1.5	2.8
Beet pulp (plain and molasses)	.1	.2	.5	.2	.1	.2	.1	.1	1.3	.4
Citrus pulp	.1	.1	.1	.1	.5	.2	.4	.1	.3	.2

1/ Rye, buckwheat, etc.

Based on 1947 Census of Manufactures, Grain Mill Products, Prepared Feeds for Animals and Fowls.

Twenty-five leading ingredients used by the mixed-feeds industry are listed in table 4 as percentages of the total ingredients used within each region. The figures in this table are only indications of the average rations produced within each region. For example, the relatively high value of 20.4 percent in the New England region for millfeeds and screenings does not indicate that more of these ingredients are used in this region than in others. It indicates only that a larger proportion of the average ration is composed of these ingredients.

Surplus and Deficit Areas

The movement of ingredients and finished products in the feed-mixing industry is complex. At certain times, ingredients move into relatively surplus areas, although the net movement for a season may be out of the area. Considerable movement of formula feeds and concentrated premixes of varying types also occurs from surplus to deficit areas, but a reverse movement during certain periods is not uncommon. Because of this complex movement a basic picture of surplus and deficit areas is desirable. If certain assumptions are made, such a picture is possible.

In table 5, individual States are arrayed on the basis of their relative surplus-deficit positions for each of the seven major ingredients used by the mixed-feeds industry. In interpreting this table, both volume of production of ingredients 6/ and size of the mixed-feeds industry in each State must be kept in mind. For example, although neither North Dakota nor Rhode Island is a large corn-producing State, they are the greatest relative surplus States because of the small size or the nonexistence of the feed-mixing industry within their borders. The lower line marks the break between surplus and deficit States, assuming that the entire production of the ingredient is used in production of mixed feeds. Such a situation would seldom occur but the assumption represents the extreme position that could be taken in utilization of the crop. The upper line also divides the array between surplus and deficit States and assumes that no less than the United States' average proportion of the States' production was used by the industry. A State listed above the upper line remains a surplus supplier even when the mixed-feeds industry in that State uses only as much of the ingredient as is consumed by the industry on the national average. Some States listed in this surplus area might actually be deficit States if a larger than average proportion of their production were used by the feed-mixing industry. The borderline areas between the two lines also represent either surplus or deficit States, depending upon the proportion of the crop utilized by the industry.

6/ As defined in this report, production refers to the quantity of each ingredient sold by producers rather than the total produced.

Table 5.- Array of States from surplus to deficit for seven major ingredients, industry consumption divided by production, 1947 1/

Surplus-deficit position	Corn	Oats	Wheat	Barley	Millfeeds and screenings	Soybean meal	Alfalfa meal
Surplus States assuming that no less than the United States proportion of their production was used by the mixed-feeds industry 1/	R. I.	N. Dak.	N. Dak.	Wyo.	N. Dak.	Ark.	N. Mex.
	N. Dak.	Wyo.	N. Mex.	Nev.	Mont.	Iowa	Nev.
	N. Mex.	S. Dak.	Wyo.	N. Mex.	Idaho	Ill.	Colo.
	S. Dak.	N. Mex.	Mont.	N. Dak.	Colo.	N. Dak.	Ariz.
	Nebr.	Idaho	S. Dak.	S. Dak.	Kans.	Ind.	Kans.
	Iowa	Nebr.	Kans.	Idaho	Mich.	S. Dak.	S. Dak.
	Ill.	Mich.	Idaho	Mont.	Okla.	Minn.	Ark.
	Minn.	Okla.	Okla.	Mich.	Wash.	Miss.	Idaho
	Ind.	S. C.	Colo.	Nebr.	Minn.	N. C.	Nebr.
	Wyo.	Iowa	Nebr.	Minn.	Nebr.	Mich.	Ohio
	Colo.	Ill.	Mich.	Kans.	Tex.	Mo.	Calif.
	S. C.	Minn.	Nev.	Wis.	Utah	Ohio	Okla.
	Ky.	Nev.	Wash.	Colo.	Mo.	Ky.	Wash.
	Mich.	Mont.	Ill.	S. C.	Ky.	Kans.	Mo.
	Kans.	Kans.	Ind.	Ore.	Ore.	Va.	Penn.
	N. C.	Maine	Ohio	Okla.	S. Dak.	La.	Minn.
	Ga.	Ind.	Tex.	Ky.	Ill.	Ala.	Tex.
	Va.	Ga.	Ore.	Ariz.	Wis.	Del.	Iowa
Borderline States either surplus or deficit depending on definition	Mo.	Utah	Md.	Md.	Va.	S. C.	Md.
	Tex.	Ore.	Mo.	Calif.	N. C.	Md.	Ill.
	Okla.	Colo.	Minn.	Wash.	N. Y.	Tenn.	Mich.
	Tenn.	Wis.	Del.	Utah	Ind.	Ga.	Ind.
	Md.	Ariz.	Utah	N. C.	Iowa	Wis.	N. Y.
	Idaho	Wash.	Pa.	Iowa	Md.	Nebr.	N. Dak.
	Ohio	Tex.	S. C.	Va.	Ohio	N. J.	Maine
	Miss.	N. C.	Iowa	Tex.	Tenn.	Okla.	Mont.
	W. Va.	Miss.	Tenn.	W. Va.	S. C.	W. Va.	Conn.
	Ala.	Mo.	Ga.	Maine	Ga.	Pa.	W. Va.
	Pa.	Calif.	Ky.	Del.	Pa.	N. Y.	N. H.
	Del.	Ark.	Ariz.	Tenn.	Calif.	Wyo.	S. C.
	Ark.	La.	Wis.	Mo.	Wyo.	N. Mex.	La.
	Fla.	Ohio	Ark.	Ga.	N. Mex.	Nev.	Fla.
	Wis.	Ky.	Va.	N. J.	Maine	Ariz.	N. J.
	La.	Ala.	W. Va.	Pa.	W. Va.	Maine	Ga.
	Mont.	Pa.	N. Y.	Ind.	Ariz.	Mont.	Wis.
Deficit States even assuming that 100 percent of their production went into the mixed-feeds industry	N. J.	Tenn.	Calif.	Ill.	Conn.	Idaho	Mass.
	Ariz.	Va.	N. C.	Ark.	La.	Utah	Ky.
	Nev.	W. Va.	Miss.	N. Y.	Nev.	N. H.	Va.
	Ore.	Md.	N. J.	Ohio	N. H.	Conn.	N. C.
	Calif.	N. Y.	Ala.	Ala.	Fla.	Fla.	Utah
	Wash.	Fla.	Maine	Miss.	Miss.	Colo.	Ala.
	Maine	N. J.	La.	Conn.	Del.	Wash.	Miss.
	Utah	Vt.	N. H.	N. H.	N. J.	Ore.	Ore.
	Conn.	Del.	Fla.	La.	Ala.	Mass.	Del.
	N. Y.	N. H.	Conn.	Fla.	Ark.	Vt.	Vt.
	Mass.	Mass.	Mass.	Mass.	Mass.	Tenn.	Tenn.
	N. H.	Conn.	Vt.	Vt.	Vt.	Calif.	Wyo.
	Vt.	R. I.	R. I.	R. I.	R. I.	R. I.	R. I.

1/ Proportion of United States production used by the feed-mixing industry: Corn 24.6 percent; oats 37.7 percent; wheat 4.5 percent; barley 22.9 percent; millfeeds and screenings 54.6 percent; soybean meal 72.4 percent; and alfalfa meal 99 percent.

Based on data available from United States Department of Agriculture and Bureau of the Census.

No State appears as a surplus State for all seven of the major ingredients, when the upper line is used as the breaking point between surplus and deficit States (table 5). The 16 States with the greatest production of mixed feeds include one--Nebraska--with a surplus in six of the seven ingredients. It includes two--Kansas and Minnesota--with surpluses in five ingredients; and four--New York, Pennsylvania, Tennessee, and Virginia--with deficits in all seven ingredients. Sixteen States having the smallest production of mixed feeds include one--South Dakota--with a surplus in six; two--Idaho and New Mexico--with surpluses in five; and four--Delaware, West Virginia, Connecticut, and New Hampshire--with deficits in all seven ingredients. The 16 States that have about average production include Colorado with a surplus in six ingredients; Oklahoma and Michigan, with surpluses in five; and New Jersey, Alabama, Massachusetts, Florida, Louisiana, Maryland, and Vermont, with deficits in all seven ingredients.

On a regional basis, all of the Middle Atlantic States were deficient in all seven major ingredients. In the New England region, only Maine appears to be a possible surplus producer of one ingredient--oats. The West North Central, Mountain, and East North Central regions are the areas of greatest surplus production; surpluses are indicated in most States. Arizona, Utah, Missouri, Ohio, and Wisconsin, however, are deficient in five or six of the items.

Combining production of the seven major ingredients, and consumption by the industry of these ingredients, the West North Central and East North Central regions are the large surplus regions. Other surplus regions are the West South Central and Mountain regions. The biggest deficit regions are the New England, Middle Atlantic, East South Central, South Atlantic, and Pacific, in that order.

SEASONALITY OF COMMERCIAL MIXING

The number of employees working in the feed-mixing plants changed little from month to month, as reported in the 1947 Census of Manufactures. The number of employees reported for the highest month exceeded the number reported for the lowest month by only 10 percent. This would indicate that either: (1) Little seasonality occurs in production of mixed feeds; or (2) operators of many feed-mixing establishments have side-line enterprises which occupy the workers during the off season; or (3) the small size and nature of the business makes the presence or absence of an additional worker more noticeable. If these two latter factors are important considerations, the seasonality of production of mixed feeds would be expected to be greater than that shown by the seasonal variation in employees. If these factors are not important, the seasonality of production would be expected to approximate the small seasonality shown for number of employees.

Table 6.- Mixed feeds: Percentage distribution of manufacturers' production specified regions, by months, July 1947-June 1949 1/

Year and month	United States	New England and Middle Atlantic (including Delaware and Maryland)	East North Central and West North Central	East South Central and South Atlantic (excluding Delaware and Maryland)	West South Central	Pacific
	Percent	Percent	Percent	Percent	Percent	Percent
1947						
July	8.9	9.2	8.3	9.1	8.0	9.5
Aug.	7.9	8.1	7.2	7.7	7.4	9.1
Sept.	8.6	8.8	8.3	8.3	8.2	8.9
Oct.	8.2	8.6	7.7	8.2	8.3	8.2
Nov.	7.6	7.7	7.3	7.7	8.1	8.1
Dec.	8.5	8.0	10.0	7.5	7.9	7.5
1948						
Jan.	8.2	8.1	8.7	8.1	8.5	7.5
Feb.	7.0	6.9	6.7	7.7	8.0	7.1
Mar.	8.5	8.2	8.8	8.3	9.4	7.9
Apr.	9.0	9.2	8.8	9.0	9.0	8.5
May	8.5	8.3	8.5	9.0	8.5	8.5
June	9.1	8.9	9.7	9.4	8.7	9.2
Total	100.0	100.0	100.0	100.0	100.0	100.0
1948						
July	7.6	7.6	7.1	8.4	7.5	8.0
Aug.	7.4	7.5	7.0	7.7	7.2	8.4
Sept.	8.1	8.4	7.5	8.2	8.3	8.0
Oct.	7.7	8.0	7.2	8.0	7.6	7.7
Nov.	8.1	8.0	8.0	7.8	8.5	8.3
Dec.	8.3	8.6	8.1	7.3	8.1	8.4
1949						
Jan.	7.6	7.5	7.7	8.0	8.0	8.0
Feb.	8.1	7.6	8.4	8.4	9.1	8.1
Mar.	9.2	9.2	9.6	8.9	8.9	8.8
Apr.	9.3	9.4	9.7	9.1	9.3	8.3
May	8.8	8.3	9.5	8.8	8.6	8.7
June	9.8	9.9	10.2	9.4	8.9	9.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

1/ 1947-48, 139 feed manufacturers; 1948-49, 149 feed manufacturers.

United States Production and Marketing Administration and Bureau of Agricultural Economics, Inventory and Hedging Policies of Commercial Mixed-Feed Manufacturers in the United States. U. S. Dept. Agr., Agr. Inform. Bul. No. 24, Sept. 1950. p. 13.

Very few data are available concerning the seasonality of production of mixed feeds in the United States. The data that are available indicate the existence of somewhat more seasonal variability than was noted for employees (table 6). Monthly production in the high month exceeded production in the low month by about 30 percent in both the 1947-48 and the 1948-49 seasons. June was the month of highest production in both years. In 1947-48 the smallest production occurred in February and in 1948-49 in August (table 6). On a regional basis, seasonality of production apparently fluctuated somewhat more in both years, and the seasonal patterns of production also differ. Production in the East and West North Central regions indicated the largest seasonality during both the 1947-48 and the 1948-49 seasons. In these regions, production in the high month was almost 50 percent greater than production in the low month. During the 1947-48 season, the East South Central and South Atlantic regions (excluding Delaware and Maryland) had the smallest monthly variation--22 percent. In 1948-49, the Pacific region had the smallest monthly variation--20 percent. Greater seasonality in production tends to occur in regions in which production is relatively larger. Seasonality tends to be smaller in low-production areas.

The feed-mixing industry apparently carries only small inventories of mixed feeds. This policy is followed because (1) ready mixed feed tends to deteriorate in vitamin quality during storage, and (2) constantly changing demand for the various types of mixed feeds implies that inventories in the form of feed ingredients permit greater flexibility in type of feed mixed. Consumption of poultry feeds tends to be greater in spring and early summer, whereas demand for laying mash is greatest in fall. In every region, except the Pacific, demand for dairy feeds increased in fall and decreased in spring when pastures became available. The Pacific Coast has a relatively large demand for dairy feeds from April through December because of lack of pastures. Within each of these major categories of mixed feeds are many individual formulas and the demand for each varies considerably from time to time.

PURCHASE AND STORAGE POLICIES FOR INGREDIENTS

The relatively short harvest periods for most crops and the relatively more stable consumption by the industry creates a problem of storage and of risk-bearing for the industry. Often mixed feeds have as many as 12 or 15 major ingredients in addition to minor trace elements. Maintaining large stocks of all these ingredients would require a considerable investment in bins and stocks, and much record keeping. However, without some storage of each ingredient, plants would find it difficult to continue operations.

According to a study made by the United States Department of Agriculture 7/ policies of feed manufacturers with regard to purchase and storage vary widely. Some manufacturers try to maintain only the minimum inventories of all ingredients; others try to hold large quantities of certain ingredients. Hedging on the futures market is used to some extent, especially by large plants having large inventories of certain ingredients. The more popular inventory practice, however, can almost be classified as hand-to-mouth buying for most ingredients, with stocks slightly above the minimum level. Lack of storage space was mentioned frequently but this appeared to be a minor reason except for the New England and Middle Atlantic regions (including Delaware and Maryland).

In each region covered by the study, the risk of loss through a decline in price was the principal reason given by manufacturers of mixed feed for not carrying large inventories of ingredients. However, manufacturers located in areas of surplus production of ingredients tended to hold smaller inventories than did those in deficit areas. This again emphasizes the fact that manufacturers of feed plan to have only slightly more stocks on hand than are necessary to continue operations in the event of delays in incoming shipments. Ingredients used in largest volume, primarily grain, were more often bought as needed, while the relatively less important ingredients, such as oil meals, were ordinarily bought in advance. Large stocks of the former ingredients were apparently held by manufacturers of mixed feed only when the plants were located in areas that were deficient in this ingredient. The fact that very few manufacturers of mixed feed used forward sales of mixed feeds as a hedge indicates that apparently the rapid growth of the industry has not been accompanied by as rapid a development of an organized market for mixed feeds.

OPERATING COSTS

Ingredients, fuel, electricity, and contract work cost the mixed-feeds industry $1,736,027,000 in 1947. The value added by manufacture amounted to $394,236,000, of which $143,301,000 represented salaries and wages. The remaining $250,935,000 covered other manufacturing costs and profits.

Cost of materials as a percentage of the value of shipments ranged from a low of 73.1 percent in the Mountain region to a high of 85.4 percent in the New England region. Table 7 shows similar data for the remaining regions. Cost of materials varies primarily with (1) prices of feed ingredients, (2) amount (cost) of transportation necessary to haul the ingredients to the mixer, and (3) the degree of finish and quality of the products purchased (premixes, for instance). Value of shipments depends

7/ United States Production and Marketing Administration and Bureau of Agricultural Economics, Inventory and Hedging Policies of Commercial Mixed-Feed Manufacturers in the United States. U. S. Dept. Agr., Agr. Inform. Bul. No. 24, Sept. 1950.

Table 7.- Analysis of the cost of operating plants producing prepared animal feeds, 1947

Region	Value of products shipped	Proportion of value of products shipped represented by: Cost of materials 1/	Value added by manufacture	Proportion of value added represented by: Total salaries and wages	Other costs and profits	Proportion of total salaries and wages represented by wages of production workers
	1,000 dollars	Percent	Percent	Percent	Percent	Percent
New England	104,100	85.4	14.6	4.8	9.8	69.5
Middle Atlantic	454,940	84.1	15.9	5.5	10.4	67.7
East North Central	438,987	81.5	18.5	7.4	11.1	55.0
West North Central	332,507	77.1	22.9	7.4	15.5	69.8
South Atlantic	196,496	82.9	17.1	6.4	10.7	65.5
East South Central	163,847	83.2	16.8	5.6	11.2	66.6
West South Central	156,569	81.7	18.3	7.3	11.0	66.7
Mountain	46,452	73.1	26.9	9.2	17.7	74.9
Pacific	237,355	80.1	19.9	8.0	11.9	69.0
United States	2,130,263	81.5 2/	18.5	6.7	11.8	65.3

1/ Material, parts, containers, supplies, fuels, electrical energy, and contract and commission work.

2/ Materials, parts, containers, and supplies amounted to 99.2 percent of the total while fuels, electrical energy, and contract and commission work accounted for the remaining 0.8 percent.

1947 Census of Manufactures, Grain Mill Products, Prepared Feeds for Animals and Fowls.

upon the quantity and type of feeds produced. Some relationship is found between the proportion of value of shipments represented by the cost of materials and availability of the seven major ingredients of mixed feeds. When consumption by the industry of these seven ingredients is taken as a percentage of production of the same ingredients, an increase in the percentage cost of materials is accompanied by a fairly constant increase in the size of the deficit of the region so far as these seven ingredients are concerned.

The value added by manufacture ranged from a low of 14.6 percent in New England to a high of 26.9 percent in the Mountain region. Only two categories can be derived from the value added by manufacture (difference between cost of materials and value of products shipped) because of the breakdown used by the Bureau of the Census in collecting the data. One is salaries and wages; the other includes other production costs and profit. Total salaries and wages had the greatest variation among regions of either cost category, amounting to 4.8 percent of the value of products shipped in the New England region compared to 9.2 percent in the Mountain region. The proportion of total salaries and wages represented by wages of production and related workers varied considerably among regions. In the East North Central region, this group received 55 percent of the total wages paid by the industry compared to the 74.9 percent paid them in the Mountain region.

On a national basis, the mixed-feeds industry paid slightly more than two-thirds of its total salaries and wages to production and related workers. The proportion of the total wages and salaries paid to production workers should indicate some of the regional differences in plant operation, as the difference between wage rates and salaries of production and related workers and those of sales and administrative personnel were fairly constant among regions. Thus, for example, the low proportion of total salaries and wages represented by wages of production workers in the East North Central region indicates the probable existence of larger sales and administrative staffs in that region.

Other production costs and profits, that is, the remainder of the value added by manufacture (gross margin), accounted for an average of 11.8 percent of the value of sales. This cost category ranged from 9.8 percent of the sales value in New England to 17.7 percent of the same figure in the Mountain region. In this instance, other costs of production include depreciation, interest, insurance, rent, taxes, and miscellaneous items of expense.

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